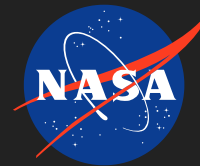


Photonic antenna coupled middlewave infrared photodetector and focal plane array with low noise and high quantum efficiency, Phase I

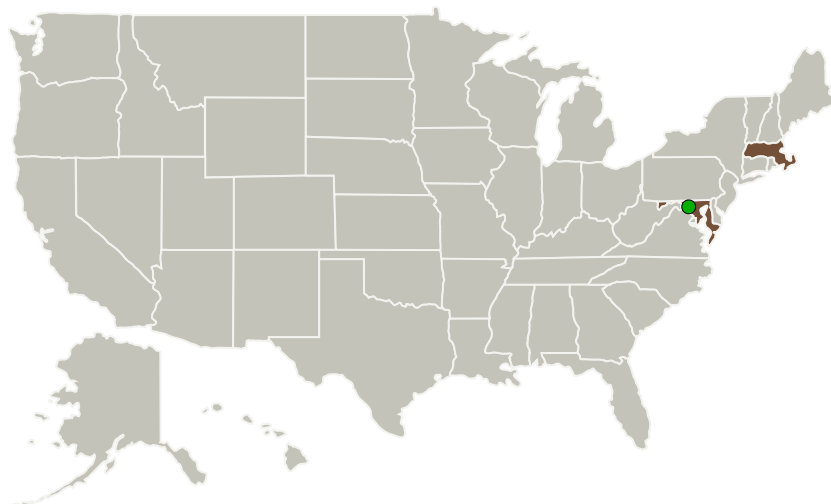
Completed Technology Project (2012 - 2013)



Project Introduction

Middle-wave infrared (MWIR, 3-5 μm) photodetectors are of great importance in numerous NASA applications, including thermal remote sensing for carbon-based trace gases (CH₄, CO₂, and CO), heat capacity mapping for earth resource locating, environment and atmosphere monitoring, and IR spectroscopy. However, existing MWIR photodetectors require a low operating temperature, below 77K to achieve high photodetectivity (D*). The requirement for cryogenic cooling systems adds cost, weight and reliability issues, thereby making it unsuitable for small satellite applications. This STTR project aims to develop a new photonic antenna coupled MWIR photodetector with a significantly enhanced quantum efficiency. In addition, the antenna technology would also allow a large-area signal collection with a small active area of the detector. Successfully developing the proposed innovation is expected to provide an enabling technology for ultra-compact high performance MWIR detection and imaging systems suitable for NASA's small satellite earth remote sensing applications. In phase I, the proposed photonic antenna enhanced MWIR photodetector technology will be evaluated and compared with existing technologies. The proposed photonic antenna structure will be simulated to generate an optimal design. A preliminary photonic antenna coupled MWIR photodetector will be developed for proof-of-concept demonstration. In Phase II, a prototype of the photonic antenna coupled MWIR photodetector will be developed and packaged with supporting electronics and software interfaces for laboratory demonstration.

Primary U.S. Work Locations and Key Partners



Photonic antenna coupled middlewave infrared photodetector and focal plane array with low noise and high quantum efficiency, Phase I


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Photonic antenna coupled middlewave infrared photodetector and focal plane array with low noise and high quantum efficiency, Phase I

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Organizations Performing Work	Role	Type	Location
Applied NanoFemto Technologies, LLC	Lead Organization	Industry	Lowell, Massachusetts
 Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland
University of Massachusetts-Lowell	Supporting Organization	Academia	Lowell, Massachusetts

Primary U.S. Work Locations

Maryland	Massachusetts
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Project Transitions

 **February 2012:** Project Start

 **February 2013:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/140689>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Applied NanoFemto Technologies, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

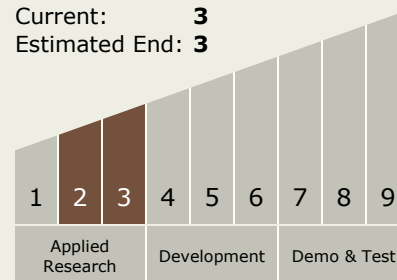
Program Manager:

Carlos Torrez

Principal Investigator:

Jarrod Vaillancourt

Technology Maturity (TRL)

Start: **2**Current: **3**Estimated End: **3**

Photonic antenna coupled middlewave infrared photodetector and focal plane array with low noise and high quantum efficiency, Phase I

Completed Technology Project (2012 - 2013)



Technology Areas

Primary:

- TX08 Sensors and Instruments
 - └ TX08.1 Remote Sensing Instruments/Sensors
 - └ TX08.1.1 Detectors and Focal Planes

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System